

## UNITED STATES PATENT OFFICE

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## PREPARATION OF MODIFIED SOY PROTEIN

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1

This invention relates to the preparation of modified soy protein, and more particularly to modified glycinin which is particularly adapted for use as a whipping agent for the preparation of nougats, fudge, divinity and cream candies, meringue powders, and for a large number of other food uses.

An object of the invention is to prepare a modified soy protein which has superior whipping qualities and which results in a foam of unusually high stability. A further object is to provide modified soy protein which is miscible in water and will whip in this mixture to a fairly light foam. A further object is to provide a process of controlled modification for the soy protein which results in a product that may be whipped with water, corn syrup, and cane sugar to yield a frappé of good body, unusually high stability, desirable shortness, and substantial freedom from any tendency for the separation of a liquid layer over at least a one-month storage period.

In general, the treatment of the soy protein may be in a series of steps in which the glycinin is isolated from the other soy bean constituents and subjected to controlled modification. The steps may consist of the extraction of the protein in soluble form from soy bean meal, the precipitation of the glycinin from the water-soluble extract at or near the isoelectric pH range of the glycinin, the washing of the precipitated glycinin, the enzymatic modification of the glycinin, and the termination of enzymatic modification by the adjustment of the pH.

In our earlier operations, the enzymatic modification of the glycinin was halted at the desired point by heat treatment which was a useful step and which present certain additional advantages in the process. We have discovered that when the heat treatment is omitted and instead a control of the enzymatic modification accomplished solely by the adjustment of the pH, the frappé produced through the use of the product has considerably greater stability.

The invention is applicable to soy protein in any suitable form. Ordinarily, the soy protein stock will consist of soy bean meal to which the process of the invention is applied. However, the invention is also applicable to soy protein in less or more pure form.

In accordance with the invention, the glycinin of the soy protein, which as isolated from the protein is practically insoluble in water at a pH of 5, is modified to render at least a substantial portion of the glycinin water soluble at a pH of 5. In the process of modification, a portion of the

2

glycinin is also hydrolyzed and is found in the product to contain nitrogen in the non-protein form.

In treating soy bean meal, the desired soy protein is separated from the other constituents of the meal. The first step may consist of extraction of the meal, which may be in the form of oil-free flakes, with water or with a dilute alkaline solution at a pH substantially different from the isoelectric point of the glycinin. The isoelectric range of the glycinin is in the neighborhood of a pH of 4.2-4.6, and the extraction liquor should have a pH at least as high as 6. A pH above 8 should be avoided in order to avoid discoloration of the soy protein and deterioration of the whipping properties of the modified protein which is later produced.

Although water may be used for the extraction, an alkaline material, such as sodium sulfite, sodium carbonate or sodium hydroxide, is preferably added to the water in a quantity sufficient to bring the pH of the extracting liquor to the desired range. Preferably, this pH is in the neighborhood of 6.4-6.8. Sodium sulfite is particularly suitable for this purpose since it serves not only as an alkaline buffer, but also acts as an antiseptic and produces better quality protein product.

The extraction of the soy bean meal with the dilute alkaline solution may be carried out at a slightly elevated temperature, preferably in the neighborhood of 130° F. The solution is filtered to separate the insoluble materials; diatomaceous earth preferably being used as a filter aid. Instead of filtration, any suitable means of separating the soluble constituents and insoluble constituents, such, for example, as screening or centrifugation, may be used. The soluble constituents consist of the bulk of the protein, the soluble carbohydrates, and the soluble inorganic salts. The insoluble constituents consist of the fiber, any residual oil which is present, a portion of the protein, and a portion of the carbohydrates.

The extraction liquor containing the soluble constituents is subjected to the second step of the process, which consists of the precipitation of the glycinin at the isoelectric pH range thereof. This is accomplished by acidifying the solution to adjust the pH to a range in the neighborhood of 4.2-4.6. Sulfur dioxide, hydrochloric acid, or any suitable acidifying medium may be used for adjusting the pH. When the pH is adjusted to the isoelectric range, the glycinin is precipitated in the form of curd solids. Any soluble constitu-